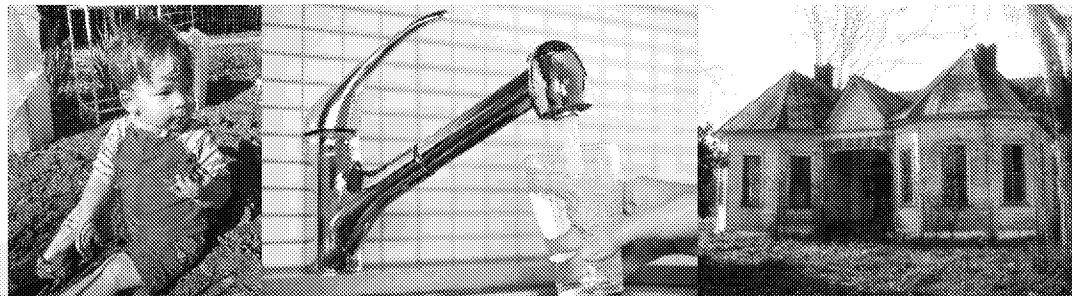


Overview of EPA Approaches to Identify High Pb Exposure Locations and Science Considerations

**EPA Lead Mapping Coordination Workshop
May 29-30, 2019
Washington, D.C.**

**Valerie Zartarian, Ph.D.
ORD Executive Lead for Pb**





Federal Lead Action Plan to Reduce Childhood Pb Exposures

- EPA Offices and Regions working to lower BLLs
- EPA ORD providing critical science and technical support
- This May 29-30 workshop focusing on EPA coordination for Goal 4, Action 2
- EPA Pb mapping efforts should be following guidance and policies to ensure defensible science and transparency of data and information



FEDERAL ACTION PLAN

To Reduce Childhood Lead Exposures and Associated Health Impacts

PRESIDENT'S TASK FORCE ON ENVIRONMENTAL HEALTH RISKS AND SAFETY RISKS TO CHILDREN

DECEMBER 2018



Drivers for EPA “Fit-for-Purpose” Pb Mapping Efforts

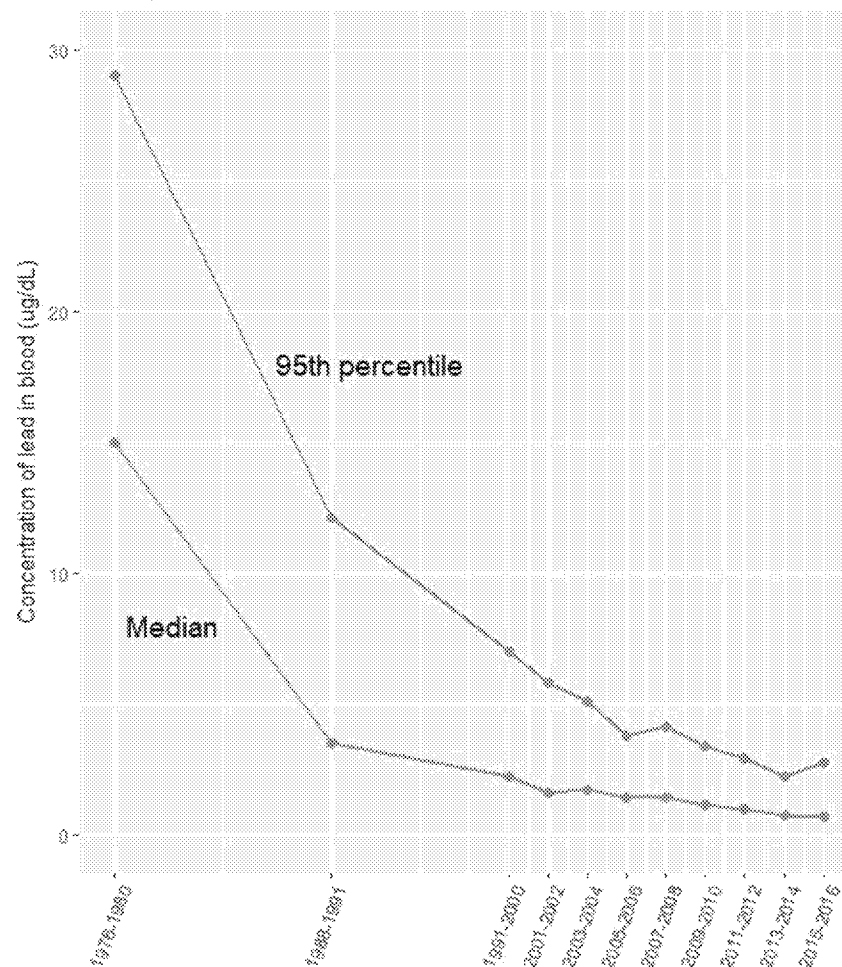
- EPA Regulatory efforts
 - TSCRA RRP, SDWA, RCRA, CERCLA, CAA
 - soil sampling, lead service line replacements, inspections
- Action on Environmental Justice
 - EJ2020 Action on Pb Disparities
 - Compliance assistance, education, training, community outreach
- Building and maintaining partnerships with states
 - Protect children from lead exposures through joint planning, data-sharing, and addressing high exposure locations



Overarching Issue to be Addressed

- Identify U.S. communities with the highest risk of childhood lead exposure.
- Target and prioritize lead exposure risk reduction, prevention, and mitigation efforts in the most vulnerable locations.
- The Agency is developing multiple approaches to address this problem and seeks to understand, coordinate, and communicate the collective capacity.

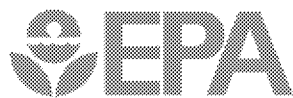
Lead in U.S. children ages 1 to 5 years: Median and 95th percentile concentration in blood, 1976-2016





Categories of Data/Science Approaches for Identifying High Pb Exposure Locations

- A) Overlay/visualize existing data layers identified as relevant to Pb exposures
 - challenges with systematic approaches to identify variables and data
- B) Develop/map exposure/risk indices
 - weight/sum housing, sociodemographic, environmental variables
 - may or may not be used to predict BLLs
- C) Develop/apply models to estimate BLLs & Identify key drivers
 - statistical regression models or physically-based exposure models
- D) Conduct technical “Convergence Analysis of available approaches and data
 - compilation and analysis of A, B, C
 - visualize & statistically analyze BLL data & convergences with models, indices
 - focus on drivers of high BLL locations not related to old housing



DRAFT Overview of EPA Approaches based on information to date

	OEJ	OCSPP - OEI	OECA	R1	R3	R5	R7	R9	ORD
Scale	national	national	national	region/ state	region/ state	region/ state	region/ state	region/ state	region/ state
Intended Audience	Internal & External	External (TBD)	Internal; External?	Internal	Internal & External	Internal & External	Internal & External	Internal & External	Internal & External
Uses EJ SCREEN?	same - yes	no	variables within	yes	yes	yes	yes	variables within?	yes
Category	A, B	A, B	A	A	A, B	A;D (with ORD)	D (with ORD)	A	C & D
Interactive ?	yes	yes	yes	yes	yes?	yes	no	yes	no
Generates new data?	yes	yes	no	no	yes	no & yes	no & yes	no	yes
Use BLLs?	no	no *	no	yes	no	yes	yes	yes?	yes

* BLL data will be used for a comparative analysis to validate data model, and end users will be able to add data into interface.



Some Initial Observations and Takeaways based on the draft summary table

- ❖ **SCALE:** Several tools with national scale focus; others regional/state/local
- ❖ **AUDIENCE:** Intended audience of most efforts is both internal and external
- ❖ **USE OF EJSCREEN?:** Most utilize variables/data within it, and add additional data
- ❖ **GIS-BASED INTERACTIVE?:** Most are being developed with that capability
- ❖ **GENERATING NEW DATA?** Some efforts are, some are not
- ❖ **USING BLL DATA?:** Some efforts are, some are not
- ❖ **There is a mix of approaches being used.**

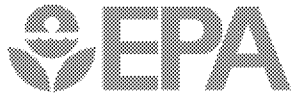


Overview of Variables/Data being used in EPA Approaches - DRAFT

Variables – Work in Progress		OEJ	OCSP-PEI *	OECA	R1	R3	R5	R7	R9	ORD
Sociodemographic	Housing: Year Built, Value, and/or Density	√	√	?	√	√	√	√		√
	Household Status: HOH Stats, Public Assistance, Renter vs Owner, and/or Occupancy vs Vacancy		?		√	√	√			?
	Income and/or Employment Status	√	?		√	√	√	√		√
	Education Level		?							?
	Ethnicity/Race	√	√		√	√	√	√		√
	Population: Age and/or Density	√	?		√	√	√	√		√
	Schools/Daycare		?		√				√	?
Environmental	Air (NEI, NATA, NAAQS, TRI)		√			√	√			?
	Soil (USGS, TRI)		?			√	√		√	?
	Sludge (DMR, CDX)		?			√	√			?
	Stream Water (DMR)					√	√			?
	Drinking Water (SDWIS, SDWA Lead Action Exceedances)		√			√	√		√	?
	Contaminated and/or Exposure Sites (SEMS, TRI)		√		√	√	√	√	√	?
	Report a Violation (RAV) System Sites					√				?
ELL	Contractors Subject to RRP				√				√	?
	Blood Lead Data				√	√	√	√	√	√

TBD - New Tool

* OCSP-PEI is considering a very broad list of additional risk factors not captured in this table. A question mark (?) signifies a variable that is TBD/under consideration.



Some Takeaways on Data Being Used Based on Available Information

SOCIODEMOGRAPHIC

- All EPA efforts summarized are using at least sociodemographic variables/data
- Most using age of housing, but different years built
- Most using income and ethnicity/race, but differences among variables
- Variation in use of some variables such as schools/daycare, household status, population information

ENVIRONMENTAL

- Most commonly used environmental variables are contaminated sites, drinking water, air (NATA) – but again, differences in specific data

BLOOD LEAD LEVELS

- Being used in some of the efforts
- Different availability of BLL data and geographic scales



ORD Update on Research to Identify High Pb Exposure Locations & Key Drivers

Problem: Identify Pb focus communities & key factors to inform decisions, drive action, and focus data/research efforts

Stakeholders: EPA AO, regional & program offices; states (e.g. ASTHO/ECOS); communities; tribes; other Federal agencies (e.g. HHS, HUD); public health community

Products to Date:

- Identification of high exposure locations in Michigan
- Data analyses in response to technical assistance requests by R5, R7

Planned Products:

- Pb mapping: continued technical support, intra- and inter- agency collaboration, data sharing
- Develop new Pb source layers at different geospatial scales
- BLLs trends analysis at national & state scale, focusing on highest exposures
- Modeling and analyses to identify key local drivers of elevated BLL for regions & states
- Collection of new data to address critical gaps

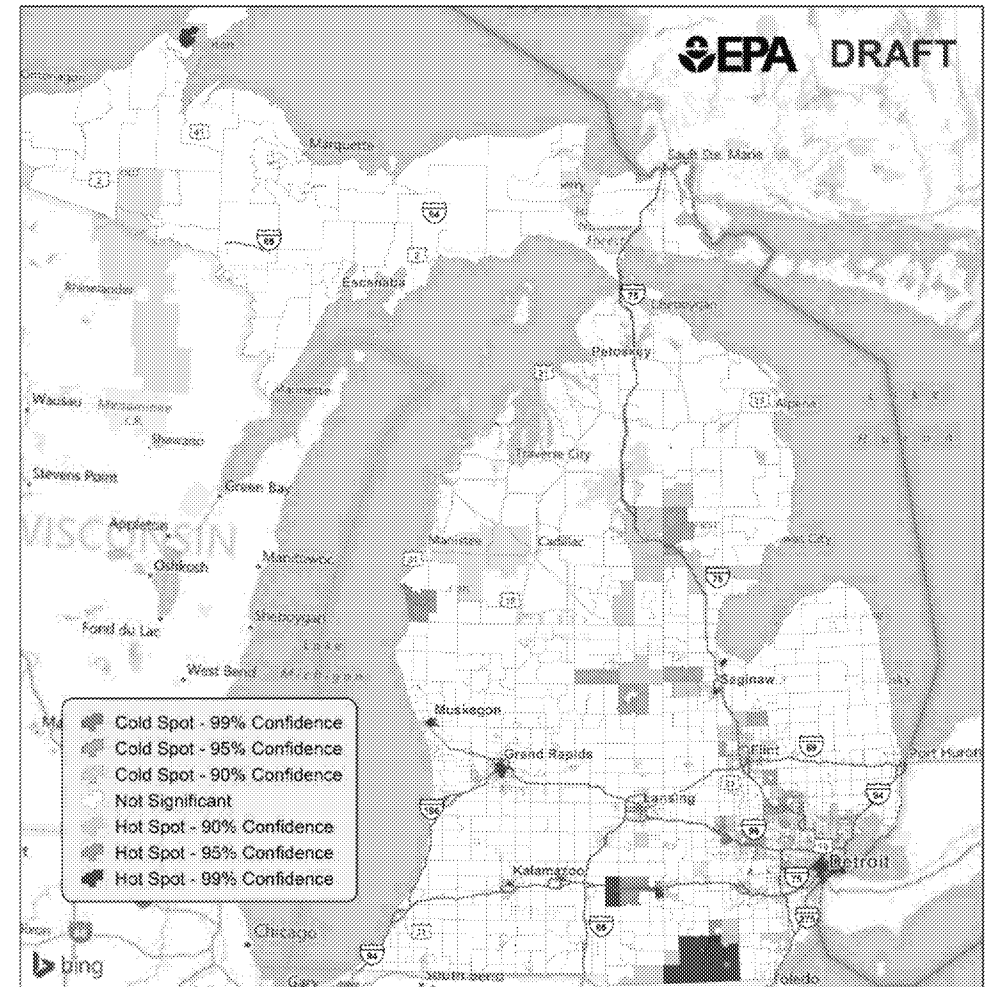
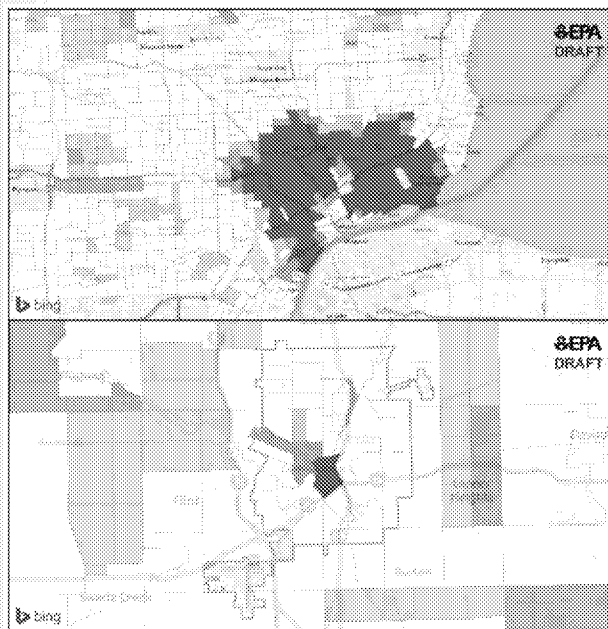
“Convergence Analysis” Approach (ORD/Regional collaboration for OH, MO, VT to date)

- ❖ Current approaches to identify high Pb exposure locations are heavily dependent on housing age (e.g. Pb paint/dust) & sociodemographics data
- ❖ Some higher BLL locations appear to be explained by those variables; others do not, suggesting environmental exposure sources (e.g. soil, drinking water, air, food)
- ❖ ORD, in collaboration with several Regions and other partners, is conducting a convergence analysis of available data at census tract level for several states
 - EJSCREEN Pb EJ Index
 - EPA model (Schultz et al., 2017, *Env. Justice*) predicting children’s BLL at census tract level
 - Available BLL data (from State and/or Reuters 2016)
- ❖ Engaging with state partners for local knowledge to help focus data collection and modeling efforts for identifying key drivers for taking effective actions.
- ❖ Engaging with Federal partners (e.g. HUD, HHS) on BLL data & their Pb risk indices

Note: This approach is generalizable to other states if BLL & other data available; other approaches/data could be incorporated in the pilots.



MI: Geospatial Statistical Analysis (Getis-Ord Gi*) for “Rate of High BLL” (2014-2016)



Xue et al. 2018, ISES Conference poster, Ottawa, Canada

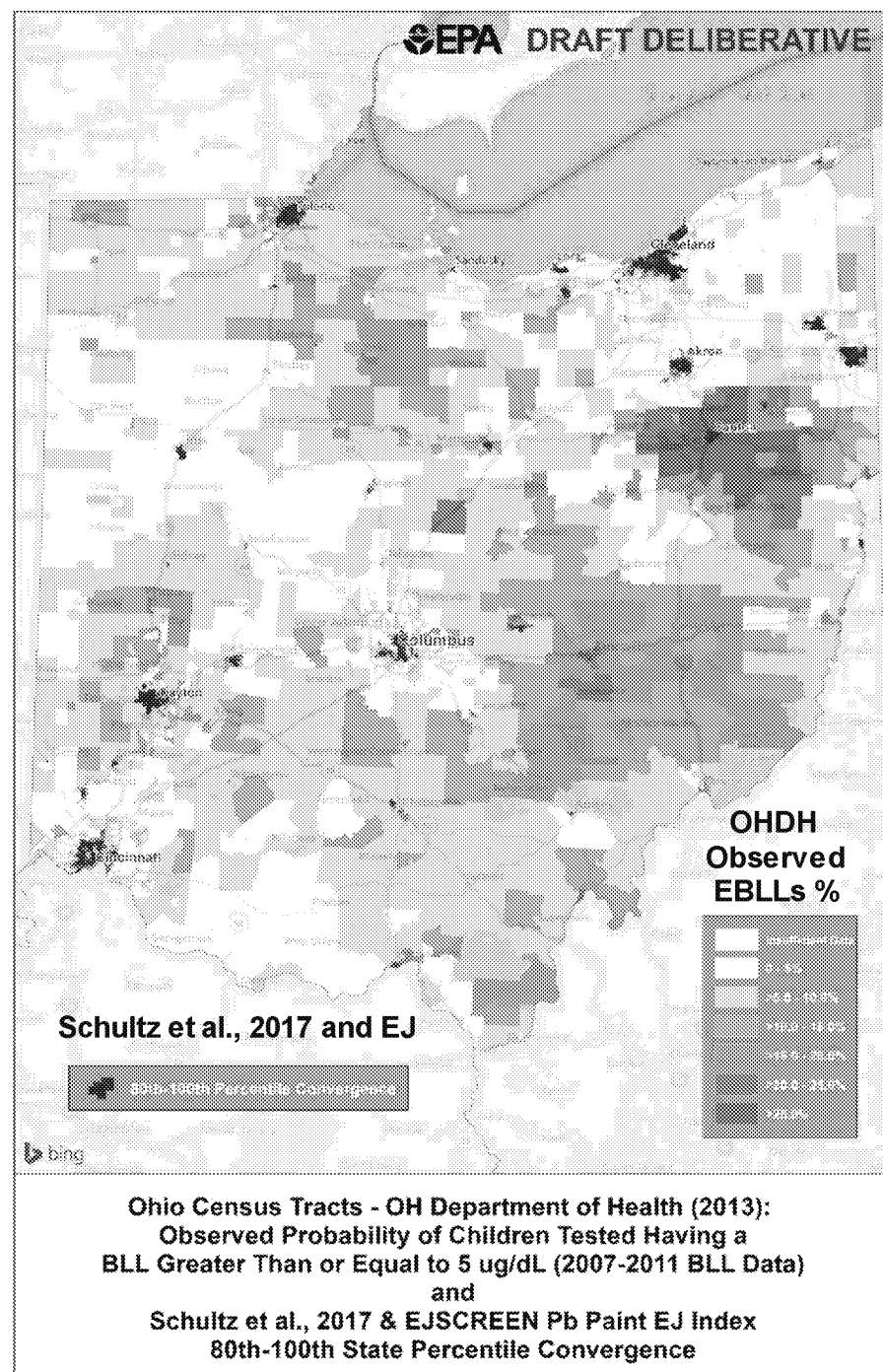
OHIO

ORD/R5 Draft Pb Analysis

Comparison	Threshold Percentile	Kappa	p
Ohio Obs vs Schultz	80	0.59	<.0001
Ohio Obs vs Schultz	90	0.53	<.0001
Ohio Obs vs EJSCREEN	80	0.51	<.0001
Ohio Obs vs EJSCREEN	90	0.39	<.0001
Schulz vs EJSCREEN	80	0.81	<.0001
Schulz vs EJSCREEN	90	0.66	<.0001

Schultz	Multiple Regression, 2014 Census BLL GM of BLL, Schultz et al., 2017
EJSCREEN	Pb Paint EJ Index
Ohio Obs	Ohio Dept. of Health Observed Probability Rate. OSU Statistical Consulting
Kappa	Cohen's Kappa agreement statistic
P	Kappa P value

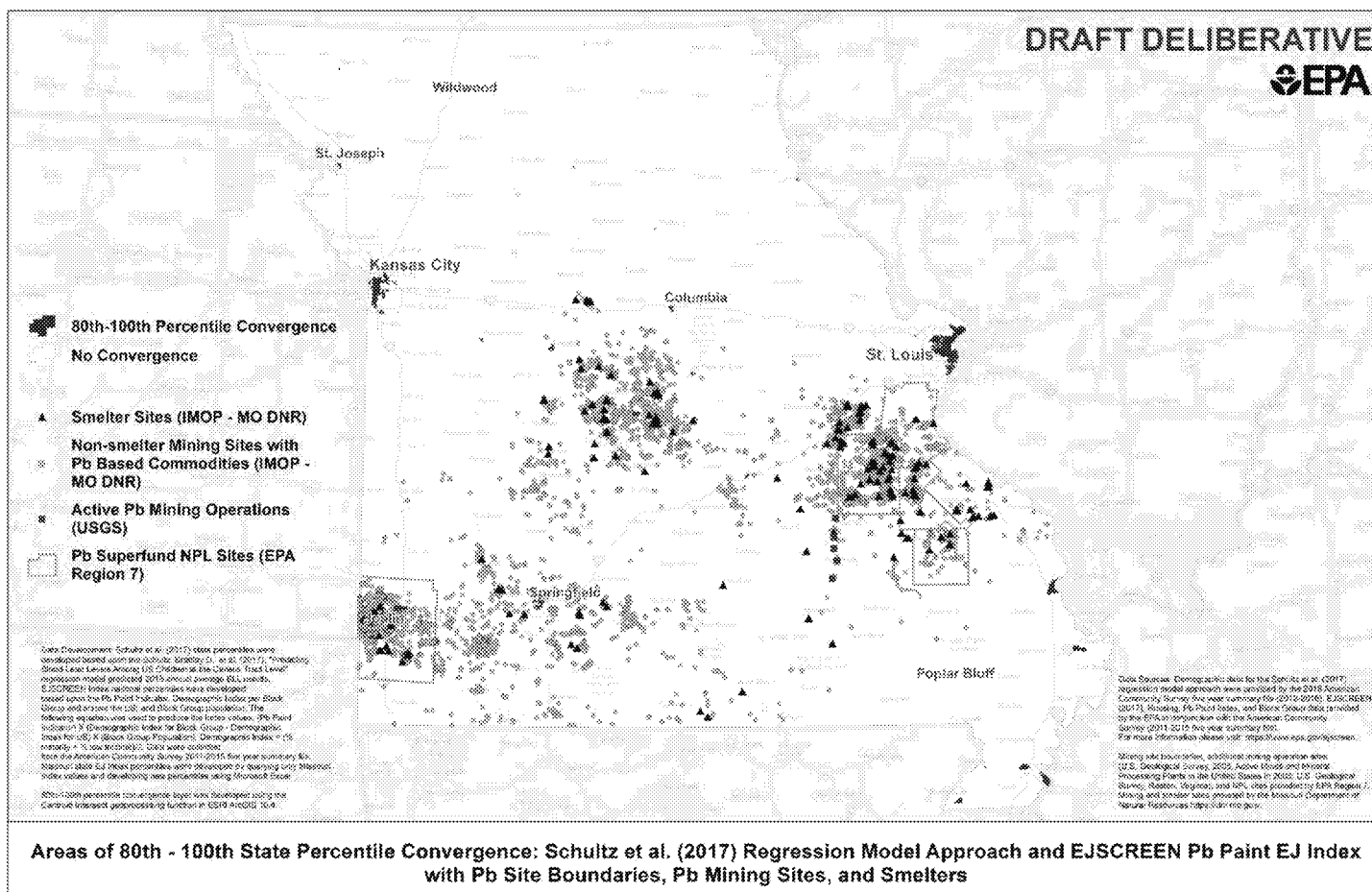
- ❖ Conducting statistical analyses to reduce subjectivity from data overlays
- ❖ Kappa scores confirm there are missing variables in the current indices/models



MISSOURI

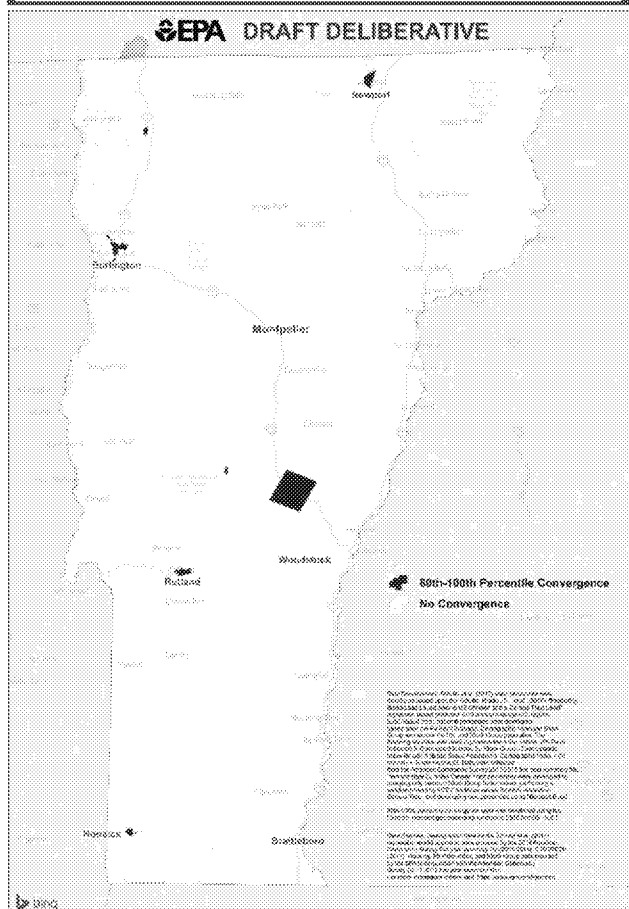
ORD/R7 Draft Pb Analysis

DRAFT DELIBERATIVE



Convergence between the EJSCREEN Pb Paint EJ Index and Schultz et al., 2017 approaches mapped with Pb Superfund NPL Sites (EPA Region 7), Active Pb Mining Operations (USGS), and MO DNR Pb Mining & Smelter Sites

**Convergence between the
EJSCREEN Pb Paint EJ Index and
Schultz et al., 2017 approaches
(based on the 80th-100th percentiles of
their respective metrics**)**

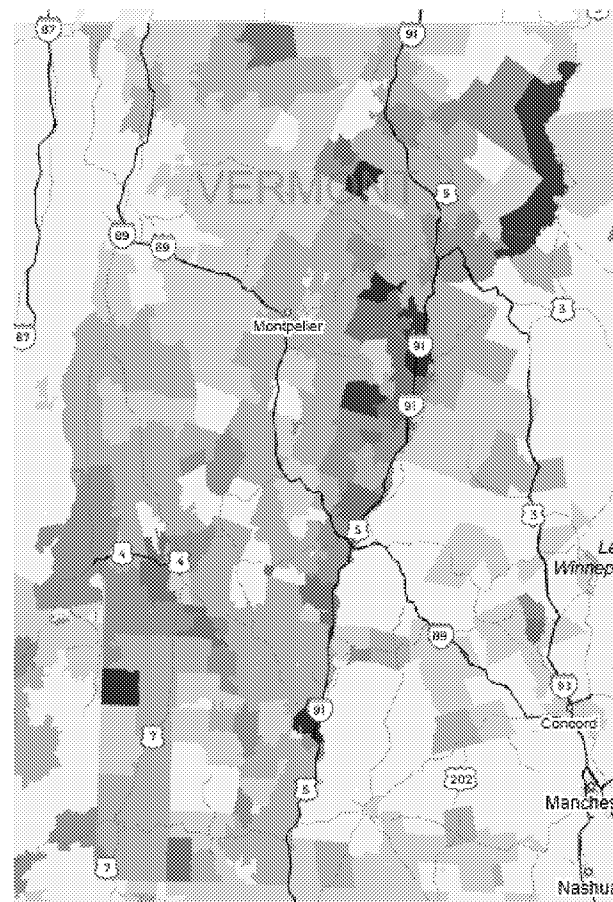


**Areas of 80th - 100th State Percentile Convergence: Schultz et al. (2017)
Regression Model Approach and EJSCREEN Pb Paint EJ Index**

VERMONT

ORD/RI – Draft Pb Analysis

**Reuters 2016 Analysis: Nationwide Analysis Map for
Prevalence of Childhood Elevated BLL by Zip Code
and/or Census Tract - Vermont (2005-2015 Zip Code Data)**



**Underlying BLL data provided by the CDC or respective
state agencies.**

<https://www.reuters.com/investigates/special-report/usa-lead-testing/#interactive-lead>



Considerations for Defensibility of EPA Efforts – Scientific Underpinnings

- EPA Policies and Procedures on Quality Assurance
 - Quality Management specifications for all EPA organizations, including approved QA Project Plans, for all applicable projects, tasks involving environmental data
- EPA Technical Review of Scientific Products
 - Best Practices for Clearance
- EPA Peer Review Guidance
 - “fundamental in developing the sound and defensible scientific and technical work products that support Agency decisions”
- EPA Geospatial Policies and Standards

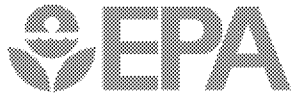
U.S. Environmental Protection Agency
Office of Research and Development
National Exposure Research Laboratory
Systems Exposure Division

Research and Development Project Title:
Understanding Multimedia Pb Exposures and Key Factors for
Vulnerable Populations

QA Category: A

ORD National Research Program: Safe and Healthy Communities

Project ID: SHC 2.63, Task 6



Science-Related Considerations for EPA Efforts - External Messaging

- ❖ Clearance procedures for external products
- ❖ AO approvals for Pb maps to be shared publicly
- ❖ Risk communication plans via partner engagement
 - needs upfront consideration and planning to understand and communicate data limitations for decisions and actions

Acknowledgements

EPA Office of Research & Development

Rogelio Tornero-Velez, Jianping Xue, Lindsay Stanek, Tony Poulakos (contractor), Anne Neale, Jennifer Cashdollar, Andrew Geller, Jay Garland, Tim Watkins, Bruce Rodan, Jennifer Orme-Zavaleta

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EPA Region 5

Alan Walts, Kathy Triantafillou, Maryann Suero, Carole Braverman (ORD/RSL)

EPA Region 1

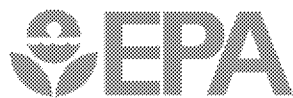
Kristi Rea, Alex Dichter, Deb Cohen, others on R1 cross-Program Lead Team

EXTRA SLIDES



Some EPA Regional Presentation Takeaways from Coordination Discussions to Date

- ❖ **Regions suggest that one size does not fit all and shouldn't fit all**
 - Flexibility needed to identify potential areas of risk and focus resources
 - One or more approaches and/or strategies may be needed for objective(s) (e.g., Enforcement, Community Outreach, Compliance Assistance)
- ❖ **Meaningful engagement with states, local, tribal partners is essential**
 - for correct problem formulation and focus
 - for help acquiring local data and knowledge to complement national data
 - for help interpreting results and potentially refining analyses
 - for effectively implementing lead exposure/risk reduction actions
- ❖ **Risk communication needs upfront consideration and planning**
 - Understand and communicate data limitations for decisions and actions



Summary of Data Sources Being used in ORD/Regional Analyses

	EJScreen Pb Indicator	EJScreen PB Paint Index	Schultz et al paper	Reuters
Extent	national	national	national	Multi state
Scale	Census Tract	Census Tract	Census Tract	Census Tract or Zip Code
Variables	Housing age	Housing age; % Minority	Housing age; % African American	BLL
Method	Literature	Literature	Empirical modeling	Monitored BLL
R²	N/A	N/A	0.69 for Michigan; 0.20 for Massachusetts; 0.28 for Texas, other states - unknown	N/A
Limitations			R ² low for MA, TX; unknown for other states.	States target and conduct monitoring differently; can't interpret without understanding monitoring regime
Use BLLs?	no	no	yes	yes



Draft Overview of EPA Approaches to identifying priority locations

- Approaches by 3 program offices, 5 different Regions, and ORD
 - Program Offices: National scale focus (primarily)
 - Regions, ORD: Regional / State scale focus
- Most of these are GIS-based interactive approaches
 - Most intended for both internal and external audiences
 - Most use EJ Screen or a similar approach
- Some efforts generate new data



Data Used in these Approaches

- Biggest differences: Use of data
 - Presence of Contaminated Sites used by Regions and OCSPP
 - Regions 3, 5, 9, and OCSPP use other environmental data
 - 4/5 Regions and OEJ use multiple sociodemographic variables
 - 4/5 Regions and ORD using BLL data; Program Offices are not